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## EDITORIAL

### De Minimis

A REFERENCE to the supposed molecular weight of insulin and a reference to the size of chromosomes in a paper by Mr. Jerome Alexander, which we hope to comment upon without undue delay, led us to waste a great deal of time in hunting for the size and weights of electrons, atoms, molecules, and colloid particles. Our ignorance of the subject is no doubt responsible for a good deal of this waste of time and many chemists could lay their hands on such information at a moment's notice. On the other hand there are probably others who have a little curiosity about such matters and few opportunities of consulting a large library and for their benefit it may be worth while some day to collect into one short article the most convenient data. Our own books do not include all the best text-books and probably all the best information is readily available somewhere. Berthout gives the diameter and mass of the negative and positive electron but many books to which we turned hopefully gave us no such items. The Encyclopædia Britannica in the article molecule gives the diameters of a few well-known gaseous molecules: the Annual Reports of the Chemical Society for 1932 give the dimensions of the molecule of fluoroamidophenyl, and Friend's Physical Chemistry, vol. 1, some information about the molecular weights and diameters of various colloids. Wyckoff gives a table of atomic distances and we suppose that by the exercise of a certain amount of patience anybody could find in such books the diameters of very many crystals. But we have no wish to do badly what has already been done well and we should like to know if there is already in existence a table showing the sizes of the large molecules and smaller colloid bodies so that we can form a mental picture of the relative sizes of the pollen grains that Brown observed, the chromosomes that induce Alexander to speculate on the origin of life, the supposed size of the molecules of insulin and Congo Red, and so on; with such a table staring us in the face we may avoid making some gross mistakes in comparing things of very different orders of magnitude. We shall welcome any advice.

### Original Thinking and Logarithms

It has always seemed to us very remarkable that logarithms should have been invented by Napier at a time when the theory of indices and the exponential theorem were unknown. But when the idea occurred to him and he realized that you could construct a table of logarithms, if he had sat down quietly and thought out the possibilities he might have constructed a very useful table of logarithms in the space of a week. To a man with his acuteness and knowledge it would have been obvious that the numbers 1, 2, 3, 4, and so on corresponded, according to his notions, with the numbers 10, 100, 1000, 10000, and so on. With these data, a little imagination and a little simple arithmetic it is not difficult to construct a table of logarithms as any readers of this JOURNAL can easily verify. If you multiply 2 by itself ten times you get 1024 and the logarithm of this will be rather more than 3: therefore the logarithm of 2 is rather more than ·3. By interpolating, an approximate figure can be obtained and from this an approximation to the log of 8 can be got. By another interpolation you can get a value for the logs of 81 and 3. From these data you get the logs of 12 and 24 and you have more not very accurate points on the curve that you are attempting to construct. Interpolating again you may get more accurate values for the logs of 2 and 3 and by interpolating from 24 you can get the log of 2401 which is $7^4$. Hence you get an approximate value for the log of 7. You can now interpolate between 1000 and 1050 and get a better value for log 2; by the exercise of a little patience you may find powers of 11 and 13 sufficiently near to ascertained points to justify more interpolation and so in the course of a few hours you can calculate the logs of two or three dozen numbers accurately to four places of decimals. On train journeys or while you are waiting for a liquid to filter or boil you may make use of $2^{20}$ and get log 2 and hence all the other logs still more accurately and we have ourselves made use of this method to calculate the value of several hundred logs to 8 or 9 places and we believe them to be accurate to 7 places. At any rate those we have checked are. This pastime is about as diverting as a cross-word puzzle and is an agreeable change. It appears to have no utility and in this lies its charm. Of course there are all sorts of tricks you gradually learn; if you wish your results to be accurate to six places of decimals it is no good interpolating between such distant numbers as 1000 and 1010. When you have the logs of 1000, 1001, 1002, and so on up to 1010, accurate to 7 places, you have a very useful nucleus to work on, and can obtain series that enable you to proceed more rapidly.

# THE CHEMIST AND THE PUBLIC HEALTH

By E. GABRIEL JONES, M.Sc., F.I.C.

It has frequently been said, when the profession of chemistry has been under comparison with others, that the medical profession is of outstanding importance because it is directly concerned with the health and life of the people, and that for this reason its members enjoy privileges by way of legislative protection which are denied to chemists. On similar grounds it is argued that the pharmacist and the dentist must have training and experience of approved kinds and must be protected from any encroachment from outside. It is not my intention to discuss the merits or demerits of these arguments, still less do I wish to court unpopularity by raising that contentious subject, the closing of the profession. What I have set myself to do is to show to your satisfaction that our sometimes disparaged profession, so often confused by "the man in the street" with the compounding of drugs and the retailing of patent medicines, does play an important part in the preservation of health and life.

Critics will probably say that I am thinking of public analysts or of other chemists whose work is especially concerned with foods or other vital necessities. I certainly include public analysts in my list of chemists who fill important rôles in connexion with the public safety, but I by no means restrict such a list to public analysts. We must surely concede to every young chemist the possibility that he or she may some day be called to occupy a position by which the health of many may be safe, or may be jeopardized, according to the efficiency with which the work is carried out.

Medicine itself owes a very great deal to the chemist, and as time goes on such contributions become increasingly important. Pasteur, the founder of preventive medicine, was of course a chemist, and to Emil Fischer we owe much of our knowledge of the proteins. Graham's work led to the knowledge of osmosis, which is now recognized as of such great importance to the understanding of many physiological processes. Erlich—to quote Sir William Willcox—"by his chemical studies and their application to medicine has been one of the greatest benefactors of modern times. . . . Erlich's name will always be associated with the discovery of salvarsan and of allied arseno-benzol derivatives which have been of incalculable value in the treatment of syphilis, relapsing fever, etc." Some idea may be gained of the importance to medicine of chemical research by a brief consideration of the work done on vitamins. Prof. J. C. Drummond, in his Cantor Lectures delivered last year before the Royal Society of Arts, mentioned, among other advances in this field, that three vitamins have been separated in an apparent state of purity, that as a result of treatment with vitamin-*A* in pregnancy it is suggested that resistance to puerperal septicaemia is increased, that rickets is rapidly disappearing, and, said Drummond, "It is not too much to hope that defective teeth will become as rare as are now the distorted limbs of untreated rickets, so common but a few years ago." We have only to think of the work of Barger, Carr, Drummond, Harington, Heilbron, Rosenheim—to mention a few names that immediately come to mind—in order to realize something of the contribution of the chemist towards the prevention and cure of disease.

In spite of all this, or perhaps because of it, I refuse to regard chemistry as the "handmaid of medicine," as has so often been done: the two professions should be looked upon as partners, rather than as master and servant.

A branch of the chemical profession which is closely concerned with the public health is that of the public analyst. His duties are connected partly with the suppression of frauds and partly with the safeguarding of the health of the community. The former is the aspect which is probably the better known; when the average person thinks of the public analyst, he visualizes watered milk or margarine sold as butter, or some other fraud of a similar character. Yet the second aspect of the work is the more important. The day has fortunately passed, at any rate in this country, when he had to protect the public from such criminal ignorance as the use of lead chromate or copper arsenite for the colouring of confectionery, or of zinc sulphate in the manufacture of cheese. I say "in this country" advisedly, for it is only 10 years since a thousand people in one of the Balkan states suffered from lead poisoning owing to the admixture of 20% of red lead with cayenne pepper.[1] Who knows what dangers would lie in wait for us were there no regular inspection and analysis of foods? I am not considering lack of scruple so much as lack of knowledge. It is only about 30 years since some scores of people were killed and thousands were ill owing to the consumption of beer containing serious amounts of arsenic. It is common knowledge how sulphuric acid containing as much as 1·9% of arsenious oxide was by mistake supplied for the purified acid used in the manufacture of brewing sugar, with the result that beer was sold which contained up to 1½ grains of arsenic to the gallon. In this connexion it would appear that only by a lucky chance was the arsenic epidemic not much more serious, for the same firm who supplied the brewing sugar commenced to manufacture table syrup by partially inverting sugar with the same sulphuric acid. A small quantity only of this syrup had been distributed, but as it had solidified, the bulk of it was returned to the

makers, and when analysed was found to contain about a grain of arsenic to the pound. A year or two later, arsenic from a different source appeared in beer. Fourteen people were found to be suffering from arsenical poisoning, and the beer they had been drinking was examined and contained up to one-sixteenth of a grain per gallon, yet the brewing sugar was arsenic-free. Eventually the poison was traced to malt which had been dried over gas coke, and this was apparently the source of the arsenic.[2]

The evidence adduced before the Royal Commission which investigated these ourbreaks proved that so many articles of food contained arsenic in greater or less degree that it makes one speculate as to how many deaths were really due to this cause, before the danger was generally recognized. Arsenic appears to be one of those evils which, like poverty, are always with us. It has appeared from time to time in various articles of food and if the public analyst served no other useful purpose he would still justify his existence by ensuring an arsenic-free food supply. While the quantities which have been found during the last quarter of a century have generally been only small, instances have occurred where serious trouble would have ensued had the impurity not been quickly detected. There was an example of this during the war. Some very impure calcium acid phosphate was supplied to the manufacturer of a mixture known as Yorkshire pudding powder and not only did this so-called acid phosphate consist to the extent of 80% of calcium sulphate, but its arsenic content was such that an ordinary slice of Yorkshire pudding made from it contained a quarter of a grain of arsenic. Among other foods in which arsenic has been detected are cocoa, from impure potassium carbonate, apples, from arsenical spray used on the trees, baking powder, and vinegar, while everyone probably remembers the scare in North Staffordshire a couple of years ago when a small sweet manufacturer used arsenious oxide as a dusting powder for sweets under the impression that it was French chalk.

Thanks to the systematic examination of all those foodstuffs in which arsenic may possibly be present, such a state of affairs as that known as "the beer scare" is now almost unthinkable, but there are other dangers. The very extensive consumption of tinned foods gives much work to the public analyst, for with foods of an acid character tin may easily be dissolved to a harmful extent if a long time elapses before they are used, and sometimes owing to the soldering of the containers lead is also found in amounts which would prove injurious if ingested regularly. In this connexion it is rather surprising to find that tinned fish packed in oil are among the worst offenders. It would seem to be a useful, even a necessary, precaution that such foods should be marked with the date before which they should be consumed, in a way similar to the dating of photographic films.

Among especially bad cases of tinned foods which have been met with during recent years the following might be mentioned: condensed milk, the container of which had been pierced, probably for re-sterilizing, and the hole soldered: one-third of a grain of lead had been dissolved while small pellets of solder were found at the bottom of the tin: some other condensed milk which had been so long a time in the containers that the tin coating had been dissolved away and much iron had also gone into solution, as much as four grains of tin and 28 grains of iron per lb. being found. It should however be mentioned that no one would have been likely to use this milk as it had a greenish grey colour and a metallic taste. Tinned cream cheese was examined because of the "blowing" or bulging of some of the tins, a large quantity of carbon dioxide was found enclosed and owing to protein decomposition a poisonous substance known as tyrotoxicon had been produced. That the cheese would have been dangerous as a food was proved by feeding some to mice, which quickly died. A few years ago large quantities of tinned corned beef had to be condemned as owing to careless soldering of the tins and prolonged keeping they had become badly contaminated with lead and other metals.

It has sometimes been found that certain tinned fruits, raspberries and loganberries in particular, have reached British ports from abroad with many of the tins bulging or burst, which is usually an indication of serious decomposition. In these cases analyses of the gases from the tins have shown that they consist almost entirely of hydrogen, produced by the action of the acid juices on the metal of the containers. This action is set up by storage in too hot an atmosphere.

In connexion with the metallic contamination of foodstuffs, it is well known that many beverages which contain organic acids are rapid solvents of lead, and in barm beer and cider this has been well recognized. Only last year outbreaks of plumbism were reported from the neighbourhood of Exeter, due to cider which had been drawn from the casks through lead pipes.[3] In some cases tin-lined lead pipes were employed and these, as frequently happens, proved quite as bad as plain lead, owing either to impure tin used or, when the tin coating is very thin, to electrolytic action between the two metals. The County Analyst found in these cases from $\frac{1}{20}$ to $\frac{1}{10}$ grain lead per gal. Lead poisoning from Devonshire cider is no new thing, in fact it has been known for centuries, but the colic associated with the drinking of it, followed sometimes by paralysis, used to be attributed to the excessive acidity of the liquid. It was pointed out, however, so long ago as 1767 that it was actually lead colic and that Devonshire cider, as it was made at that time, contained lead from the presses and storage tanks, which were commonly lined with lead. The man who made this statement received little thanks, his disclosures produced a storm of criticism, and he was denounced as a traitor to his country.

Until 1925 copper was allowed in small amounts for preserving the colour of tinned peas and other green vegetables, and constant vigilance had to be exercised to prevent the importation of such vegetables containing excessive quantities of the

metal. A limit of half a grain of copper per lb. was adopted, but as much as four or five times this quantity was found on occasions, and one would sometimes see these heavily-coppered peas lending a brilliant splash of colour to the salads served in hotels and restaurants. Now that copper is prohibited as a colouring agent, we are often supplied with these vegetables dyed with—so far as we know—a harmless aniline dye, but in my opinion this is often overdone. I believe most of us would prefer to eat peas which have lost a little of their chlorophyll colouring rather than have them served up rivalling the Mediterranean in blueness.

Within the last five years attention has been called to the risk of poisoning by antimony owing to the use of cheap enamelled vessels for acid drinks such as lemonade. The vessels, usually pails or jugs not intended to be used for foods, are coated with a glaze containing antimony oxide in place of the tin oxide employed in the more expensive kinds, and, as any chemist would know, or at any rate suspect, the action of acids such as citric and tartaric is to dissolve some of the antimony. That this actually happened was first brought to public notice in the summer of 1928, when during a spell of hot weather the proprietors of a large store decided to provide cooling drinks for their employees. They purchased so-called lemonade crystals, which consisted essentially of sugar, tartaric acid and a little sodium bicarbonate, and dissolved these in water in a number of white enamelled pails, and in order to ensure everything being perfectly clean, new pails were used for the purpose. The result was as though these unfortunate people had been heavily dosed with tartar emetic, but fortunately they all speedily recovered.[4] About a year later a similar outbreak occurred in a school, and a third last December in a London hospital, but in these cases the acid was derived from lemons and the beverages were prepared in large white enamelled jugs. The Ministry of Health early this year issued a special memorandum dealing with the risks of using, for the preparation or storage of food, enamelled vessels obviously intended for other purposes.[5]

In a large seaport there is much work for the chemist in connexion with imported foodstuffs, for not only may they be preserved or coloured with materials which are inimical to health, but it sometimes happens that accidental mixing in the hold of a ship may have rendered them injurious, or owing to faulty storage, foods may have become mouldy or have suffered decomposition. Sugar contaminated with red lead and flour containing copper sulphate, which have been known, are of course easy to diagnose, but foods damaged by sea water may present greater difficulty, for the chemist must be prepared to give an opinion as to whether or not they are fit for food. Obviously he cannot always recommend the drastic measure of destroying a large consignment, but when, as has happened, he receives samples which are contaminated with sewage fungus, through immersion in badly polluted water, he must either be sure that the foods are such as can be efficiently washed or he must condemn them. Such problems as these presented very great difficulty during the years of the war, when no unnecessary waste of food could be tolerated, and owing to the unusual hazards run by sea-going ships many damaged cargoes came into our ports. A recent illustration of the necessity for chemical supervision of imported foods is provided by the large consignment of carcases of mutton and lamb which during last year came into a British port and was found to have been contaminated by a liquid and thereby stained. The liquid had drained from a cargo of hides stored on deck and was arsenical, and the carcases with which it had come into contact were impregnated with arsenic.[6]

There are other directions in which the chemist is called upon to assist a Port Authority, as for example in the fumigation of ships for the destruction of disease-carrying vermin. The commonest method is by the use of sulphur dioxide, but some years ago fumigation with hydrocyanic acid was started and it was obvious that such a process could not safely be carried out except under chemical supervision. Indeed, the necessity for this precaution was emphasized by fatalities which occurred at a south coast seaport during the treatment of a liner by this method. The chemist's part is to determine the way in which the fumigation can best be performed, the quantity of the gas required, and the freedom of the atmosphere from poisonous quantities before allowing anyone to enter the ship. The hydrocyanic acid was at one time prepared by introducing a strong solution of sodium cyanide into sulphuric acid through a long tube and following this with sodium carbonate in order to help the diffusion. More recently glass bottles, each containing about 700 c.c. of 80% acid, have been employed. An analysis of the contents of one of these bottles is occasionally made to ensure a sufficient quantity being used, and as the liquid is under slight pressure and boils when the cap is removed, the opening and sampling in the laboratory provide some excitement not unmixed with anxiety.

That problems of a varied character engage the attention of the chemist to a Port Authority is illustrated by the following example, for details of which I am indebted to Prof. W. H. Roberts. During one of the last months of the war a ship came into the Port of Liverpool upon which four deaths had occurred while she was lying in Dublin a few days previously. The ship was carrying maize meal and wheat flour, some of which was fermenting owing to the bags having been damaged. She also carried fuel oil and a portion of this had leaked into the bilges. Four stevedores who had entered one of the holds had been rapidly overcome and died, and an officer who was standing by when the hatch was opened had been taken ill. On the vessel's entry into dock at Liverpool, samples of air from the hold were taken and analysed; they contained on the average 16·1% oxygen, 6·0% carbon dioxide, and

·1% carbon monoxide. It was considered very unlikely that any carbon monoxide would be produced during the fermentation of the grain and the only other source appeared to be the fuel oil. A bottle of this was accordingly examined and in the air space above the liquid traces of carbon monoxide were detected. The effect of slight warming of the oil was then tried, three fluid ounces being placed in a 20-oz. bottle and warmed at 80° F. for half an hour with occasional shaking, in order to simulate in some degree the condition in the hold. The air in the bottle was then found to contain 0·5% of carbon monoxide. Some of the oil was warmed in an open vessel for two hours with constant stirring, after which it was entirely free from the gas.

The opinion was expressed that the oil contained carbon monoxide held in solution. Owing to the conditions in the hold this gas was liberated and diffused upwards through the cargo, so that in the course of time there would be considerable amounts in the spaces between the cargo and the deck, and the air in those spaces would therefore be very deadly. The probability was that this air had a paralysing effect on the men who entered the hold and being unable to extricate themselves they were asphyxiated.

A very important contribution of the chemist to public health is in connexion with water supplies. We who live in places where we can obtain a supply of pure water simply by turning a tap do not often pause to think of the work that has led up to this desirable state or of the conditions which still obtain in some less favoured communities. In the light of our present knowledge, it is staggering to read of the conditions even in the middle of last century in those places which were sufficiently enlightened to have regular analyses made of their water supplies; over those which were not so advanced a veil must be drawn. The Medical Officer for the City of London in 1861 reported that whilst the water supplied by the New River Company "had not been objectionable," that from the City pumps, which was being extensively used, was of a very different character, and he made some startling disclosures in regard to them. A few figures (converted into parts per 100,000) taken from his report will convey sufficient to those accustomed to water analyses: the total solid matter was in most cases over 100, chlorine from 2·3 to 21, nitrogen in the form of nitrates from 0·4 to 4, combined ammonia (probably including nitrogen in organic combination) 0·7 to 3. The report continued: "These results show that the City pumps are not only charged with decaying organic matter, but also with the saline products of its oxidation . . . the existence of so large a quantity of common salt is suggestive of the filthiest impurities. Most of these waters are bright and sparkling and they have a cool and agreeable taste, they are therefore much sought after for drinking purposes. . . . Many of the pumps are in close proximity to the fat graveyards of the City, and it is more than probable that all of them derive a portion of their water from these sources . . . in fact, they are the only open spaces through which the rain can percolate to reach the shallow wells."[7]

The chemist, of course, cannot claim all the credit for the vast improvements which have taken place, but we owe a great deal to those pioneers who devised our present methods of water analysis, by which the impurities, often very minute in amount, which are introduced into water on contamination with sewage, can be rapidly and accurately estimated. In consequence, water-borne disease is infinitely less frequent than used to be the case, although experience has shown that vigilance can never safely be relaxed, for when an epidemic due to polluted water does occur it is generally from some unsuspected source and, from its very nature, the disease often gains a firm hold before the danger is realized. A classical example was the Maidstone typhoid epidemic in 1897. For many years previously the incidence of typhoid in the town had been very low when compared with other parts of the country, then without warning occurred what was described as "an epidemic of typhoid unique for its magnitude in the annals of British medicine." Maidstone derived its water from a number of springs in a subsoil which consisted largely of clay, and which would therefore tend to shrink in hot dry weather and to become fissured. Analyses of the water were made fortnightly up to the end of June, after which as a measure of economy it was decided to rely on quarterly analyses. Unfortunately, this decision coincided with the beginning of an exceptionally dry period, the rainfall being the lowest for twenty-seven years, and a part of June, the whole of July and the early part of August were practically rainless. Meanwhile, hop pickers and others were encamped near one of the springs—probably there was typhoid among these people—and the rain which fell in the latter part of August would have caused decaying matter from the surface to be washed through cracks in the clay into the subsoil water. Early in September seven cases of typhoid were notified in three days, a few days later twenty-seven more, and on the following day another twenty-six. Samples of water taken for analysis on September 19 and 20 showed a very large increase in the amount of nitrates as well as other evidence of sewage contamination. Before the epidemic had been stamped out, 1681 persons out of a population of less than 30,000 were infected, while in the district supplied by the springs principally inculpated the number of cases represented 8% of the population.[8]

In a new edition, published this year, of a well-known book on water supplies there occurs the statement: "The last large outbreak of water-borne enteric fever occurred in Hanover in 1926, but Great Britain has now been free from water-borne epidemics of these diseases for many years." On the same page is a footnote: "During the passage of this edition through the press water-borne epidemic typhoid fever has occurred in Yorkshire."[9] This refers to the outbreak at Malton last year, which came as something of a shock to the whole country. The

infection in this case was due to the breaking of a drain from a hospital, whereby typhoid-infected sewage soaked into the soil only a short distance from the pumping station for the water supply, into which the sewage made its way. The number of cases was 270, nearly 5% of the population, and of these 23 died.[10] Recently an epidemic of illness said to be due to contaminated water has been reported from Kidderminster, but at the time of writing very little detail is available.

The safeguarding of the purity of the water supply is obviously of paramount importance, and the authority responsible relies very largely upon regular chemical analyses to show whether any change is taking place which may indicate danger. When pathogenic bacteria gain access to a water, they are almost always accompanied by substances, detectable by chemical means, which point to the potential danger: chemical analysis does not actually detect the bacteria—that is the function of bacteriology—but it does what is probably more important: it shows when the condition of the water is such that these bacteria are likely to be present.

Another important function of the chemist in connexion with water supplies is to ascertain whether a water which in other respects is satisfactory will exert a solvent action on metals with which it may come into contact, and so render the supply harmful to persons drinking from it. It has long been recognized that certain classes of natural waters have a marked solvent action on lead; a paper read before the British Association in 1861 drew attention to the danger, for that reason, of the water then supplied to Manchester, and that used in Sheffield was similarly condemned. In 1882 a solicitor in practice in Huddersfield successfully sued the corporation of that town for damages resulting from the injury to his health consequent upon drinking water which had a powerful action on lead, and it was proved that the water was capable of taking up as much as 1·1 parts of lead per 100,000 on standing in the pipes over-night. It was stated at the hearing that the water contained a trace of free sulphuric acid from ochreous springs, but it is now known that most instances of plumbo-solvency in waters are due to organic acids derived from peaty matter picked up in the gathering grounds. In this connexion it is interesting to Liverpool people to know that so long ago as 1868 an investigator reported that the water of the River Vyrnwy, from which we now obtain the greater part of our city supply, had no action on lead although it was very soft, and he attributed this immunity to the presence of calcium phosphate.[11] The most recent instance of injury from this source is that of Aberdeen, where according to press reports the supply to more than one hundred houses contained a quantity of lead above the usual limit of safety. It was stated that an inquiry made by the Medical Officer of Health had shown that 51 persons, out of 102 examined, showed symptoms of lead poisoning, while two deaths were attributed to this cause. The danger is much greater where water is carried for long distances through lead pipes, and in one of the cases quoted the length of the pipe was 400 yards.

Lead is not the only danger of this kind: many waters will dissolve zinc, and cases are recorded of illness caused through the use of galvanized-iron pipes or the storage of such waters in galvanized tanks. One of the most serious occurred in 1900 in the Malay Peninsula, where an Indian regiment suffered severely from gastro-enteritis, at first supposed to be a form of dysentery, but eventually proved to be due to zinc poisoning. The water supply was obtained from the rainfall collected on the galvanized-iron roofs of the barracks by means of zinc gutters and stored in a galvanized tank, and the Government Analyst found that it contained 1·1 parts of zinc per 100,000 when collected directly from the roof, and in the tank, owing probably to precipitation as carbonate, the amount varied from 0·33 to 0·48.[12] Last year damages were awarded against a local authority in Ireland and a contractor for personal injuries caused by drinking water from a pump erected in a public place, the water having passed through 50 yards of galvanized pipe and having dissolved serious amounts of zinc. Water which had been standing in the pipe was found to contain as much as 1·6 parts of zinc per 100,000.[13]

Closely connected with the problems of water supply is that of sewage treatment, for it is easy to realize that failure to dispose in a satisfactory manner of sewage would entail a menace to the health of a community. Places situated on the sea-coast or on a tidal estuary have a relatively easy task, but inland towns are not so favourably placed in this respect, and it is necessary to ensure that domestic and trade wastes are so treated as to be innocuous when discharged into an inland river or stream. The importance of this is manifest when it is remembered that many communities are compelled to use river water as their only available supplies and that London is mainly dependent on such sources. In recent years the process of chlorination has been developed, and by its means waters which are not above suspicion can be rendered safe for drinking.

The problems of water distribution and of sewage disposal are of course largely matters of engineering, but in both chemistry plays an important part. They furnish an excellent illustration of the necessity for collaboration, and, fortunately, chemistry is no longer regarded as a spare-time occupation for members of other professions.

Of increasing importance in connexion with water purification is the treatment of swimming baths; this was realized even before it was pointed out by one of our popular newspapers, for a few years ago the Ministry of Health issued a report which showed that there existed some danger of the transmission of disease by such means, although it had sometimes probably been exaggerated. The Ministry recommended that in order to maintain the water in a safe condition, continuous aeration and filtration should be employed, followed by treatment with a small quantity of chlorine. The purification is often

aided by the use of alumino-ferric to coagulate organic matter, and a small quantity of alkali must be added to neutralize the acid formed. It was recommended that an amount of free chlorine between 0·2 and 0·5 of a part per 1,000,000 should be maintained in the bath water.[14] The superintendent of a public bath is usually provided with materials for checking the approximate quantities of chlorine and alkali in the water, but the ultimate responsibility for obtaining the desired results must rest with the chemist. Experience has shown that it is unsafe to rely upon such estimations without skilled supervision, for errors which are unexpected, and to the chemist almost incredible, do sometimes occur.

The public analyst who is also consulting chemist to the local authority in a large town finds himself called upon to undertake a great variety of investigations in the interest of the public welfare. Some years ago for example it was thought that many of the cinemas and other places of entertainment in Liverpool were insufficiently ventilated, and for some weeks a squad composed of members of the City Analyst's staff systematically visited these places, in order to obtain samples of air for examination unobtrusively and under normal conditions. This of course had its lighter side and I like to recall the entertainment I derived from sitting through a performance in the "gods" of one of the less known theatres, wearing an old overcoat and cap and smoking a clay pipe, and I remember another occasion when I visited eight cinemas in one evening, leaving a taxi in an inconspicuous place round a corner. This investigation, I might mention, did a great deal towards ensuring the adequate ventilation of these buildings.

In many parts of the country, with a view mainly to smoke abatement, investigations of atmospheric impurities are going on by means of periodical analyses of the rain water collected in special gauges, for it has long been realized that pure air is necessary for the maintenance of health, whilst with the increased popularity of flying the reduction of smoke is of very great importance. When one thinks of the dangers introduced into aviation by fogs and of the fact that in the neighbourhood of large towns visibility is frequently restricted for days together to not more than a few hundred yards, one realizes that any work the chemist is doing towards remedying this state of affairs is extremely important. Some caution is necessary, however, when interpreting the figures published from time to time; it is not always safe to accept them as representing the average atmospheric impurities in a town, because the number of gauges is relatively small and the results only reflect the conditions in the particular localities in which they are placed.

Analyses of air have sometimes to be made because of complaints of illness alleged to be due to lack of proper ventilation and if, as in the case of some of the newer buildings, ozonized air is introduced, this latter process has sometimes been blamed for ill-effects said to have been experienced. But that imagination plays a not inconsiderable part is illustrated by a statement made to me by a ventilating engineer that he had known a person complain that the ozone was affecting his eyes when, as a matter of fact, the ozonizing plant had been out of action for some weeks.

Air analyses are also required when escapes of illuminating gas or sewer air are suspected. In connexion with the former, an ingenious safety lamp made by International Gas Detectors, Ltd. has been found useful. It is an electric lamp having two bulbs, one colourless and the other red. When switched on the colourless bulb is lit up, but if it is taken into an atmosphere containing inflammable gas, combustion of this gas is set up by means of a heated filament, the carbon dioxide formed is absorbed by soda lime and the vacuum so produced causes the closing of a circuit and the red bulb is illuminated.

Some important work bearing upon atmospheric impurities has recently been published by Dr. J. T. Dunn and Mr. H. C. L. Bloxam. It deals with the composition of dusts in certain areas where lead, arsenic, zinc, and copper were evidently present in suspension in the atmosphere. An account of this work recently appeared in the JOURNAL.[15]

The chemist is frequently asked to elucidate the cause of illness reported to the Medical Officer of Health or to the police. In some cases he "draws a blank" as for example when milk, tea, or some other harmless commodity is suspected of being the cause of pains or other symptoms in a child of tender years while in reality these are due to a meal of, say, meat pies and pickled onions or to a plethora of green apples. Sometimes of course there is real justification for invoking the aid of the chemist. Some years ago a number of children in Liverpool picked up and ate some biscuits resembling gingerbreads, after which they were all ill. It transpired that these were worm cakes and contained among other ingredients 2·6% of calomel and 0·9% of santonin. Another case reported to the police was was that of a man who was supplied with what purported to be a bottle of a mineral water, the contents of which burned his mouth and caused violent sickness. This proved on analysis to be "neat" amyl acetate, with which by some mistake the bottle had been filled.

Many are the instances in which sweets are suspected as the cause of illness in children, but the suspicion is generally without foundation. A case occurred however a few years ago when chocolates were found to have been responsible for the death of several children. These chocolates were old and mouldy, and by decomposition that very poisonous substance, tyrotoxicon, had been produced. In another case in which sweets were implicated, the articles were fortunately seized and destroyed before any harm had been done. These were Easter eggs which had been prepared from the sweepings of a chocolate factory and proved on analysis to contain 3·5% of sand, besides particles of glass and sawdust, and traces of lead and other metals.

Cases of so-called "ptomaine poisoning" are fairly frequent but real ptomaine poisoning is extremely rare, the great majority of cases of illness arising from food being bacterial in nature and in such instances the first symptoms do not appear until several hours after the food has been taken. Very occasionally, however, decomposing foods are eaten which contain poisonous alkaloids produced by putrefaction and an instance of this occurred a few years ago. A man procured from an eating house, and ate for his breakfast, some brawn which had been exposed to the air throughout a hot week-end. *In three quarters of an hour he was dead* and an examination of the contents of his stomach showed the presence of the alkaloid ptomatropine.

During the food shortage occasioned by the war, many food substitutes were tried and one of these, which at first sight appeared to be quite harmless, was the cause of death in at least one instance. Green vegetables being scarce, some people used rhubarb leaves as a substitute for cabbage: this would doubtless have been without ill-effect but for the fact that the leaves were boiled with bicarbonate of soda, as is the practice with many such articles, and as they contain a large quantity of calcium oxalate the effect was to produce sufficient poisonous sodium oxalate to have fatal results.

It is manifestly impossible in a short paper to touch upon all the contributions of the chemist in his field, but I think I have shown that his share in safeguarding the health of the community is no negligible one. With changing conditions the scope of the work naturally extends and fresh problems arise. Sir George Newman, Chief Medical Officer of the Ministry of Health, in his Annual Report for 1932 mentions some possible dangers to health introduced by the scientific treatment of foods, such as *the use of bleaching agents and other "improvers"* in flour, the indiscriminate addition of vitamins to foods, the introduction of new synthetic colours and flavours. One is bound to admit that there may be justification for his anxiety but does not a little reflection bring to mind many other problems awaiting investigation and suggest that some machinery should be set up for this purpose? The only method at present available, so far as I can see, is for a public analyst, who believes some treatment of food to be inimical to health, to warn the persons responsible and, if it is persisted in, to recommend the institution of legal proceedings. In the latter event he must produce medical and other evidence to support his contention, the defence will no doubt bring evidence to the contrary effect and the result is probably "as you were." Meanwhile the unfortunate public analyst has saddled his Authority with heavy costs and made himself generally unpopular.

There are, too, many problems having a direct influence on the public health which lie outside the official duties of the public analyst. I mention two which come to mind: the use of injurious dyes in articles of clothing and the pollution of the atmosphere by motor traffic. A certain amount of work has been done in these directions and in regard to the latter I understand that a Liverpool chemist has recently invented an apparatus for attachment to vehicles, which should lessen the danger. But the question arises: are not all of these matters of sufficient importance to the public health to merit something more than the efforts of a few individuals working independently and generally at their own expense? To my mind some organized scheme is most desirable and it would surely be appropriate for the Ministry of Health to take the initiative and to finance such investigations as are likely to yield useful results. There seems here to be a vast field for collaboration between chemistry and medicine, and given the opportunity I am quite sure that the chemist will be ready to do his share.

In conclusion, I wish to thank Prof. W. H. Roberts for much valued assistance in collecting the data for this paper.

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## INDIAN IMPORTS

The Survey of the Import Trade of India for the 6 months April to September, 1933, shows that although total imports were less than last year, the United Kingdom share of these rose from 35·7% to 41·1%. This improvement is attributed chiefly to Ottawa preferences: in many trades affected by these, including paints and colours, lubricating oils, woollen piece-goods, and several classes of metal goods, imports from the U.K. increased, although total imports showed a decline.

Imports of chemicals were reduced in value from Rs. 141,50,000 to Rs. 126,50,000, mainly on account of reductions in sodium carbonate, sodium sulphite, and sulphur: the values of chemical imports under other headings were all slightly lower than last year. In the drugs and medicines group, camphor and proprietary and patent medicines were imported in smaller quantity, but arrivals of quinine were substantially greater. Imports of all coal-tar dyes, except indigo and other powdered vat dyes, were substantially lower. In the glass and porcelain trades total imports were lower, but those from the U.K. were only slightly affected. A remarkable recovery took place in imports of aluminium, which increased in value from Rs. 7,50,000 to Rs. 14,75,000.

# THE CONTROL AND MEASUREMENT OF TEMPERATURE IN AN INDUSTRIAL LABORATORY

By E. A. COOKE and J. C. SWALLOW

*Synopsis of a paper read before a meeting of the London Section on December 4*

*Introduction.*—The control and measurement of temperature with reasonable precision over a large range is of importance in a modern industrial laboratory. The thermostatic devices which are described here for the range −200° to 1100° C. are not novel, but are the best combination of the many published methods which have been found by experience to be the simplest and most reliable.

*The range* −200° C. *to* −10° C.—In this range below −170° C. liquid oxygen baths must be used as in the Cryogenic Laboratory at Leiden.[1] From −170° to −10° C. carefully dried pentane[2] is used as the bath liquid and is contained in a Pyrex vacuum vessel with a German silver top carrying a stirrer and a copper spiral in which liquid air evaporates. The regulation of temperature is maintained by having a small heater underneath the stirrer, through which flows the current controlled by the change of pressure in a bulb filled with hydrogen. The liquid air is conveyed to the cryostat by a lead which is double walled and evacuated. The temperature can be maintained to 0·01° C. for hours at a time. Care must be exercised, however, to prevent a large quantity of liquid air coming into contact with the pentane, otherwise a serious explosion may result.

*Use of thermionic valve relay.*—In all the thermostatic devices in the laboratory use is made of a simple but most effective relay first described in 1923.[3] When electrical contact is made between the mercury in a mercury-toluene regulator or a gas regulator and a metal point with the object of working a relay inevitable sparking occurs at the surface, which fouls the mercury and soon destroys the sensitivity. By using a thermionic valve in which the contact at the surface puts a negative bias on the grid of the valve through a 5 megohm resistance, the plate current, which is sufficient to actuate the relay, can be stopped and the current broken at the mercury surface can be reduced to a few micro-amps. on account of the high resistance in the grid circuit. Such a relay can be arranged to make or break contact on the relay when contact occurs on the mercury surface. Such an arrangement is used on the regulator of the cryostat described above. The intermediate range between −10° and 10° C. is difficult to control, the method used being to circulate by means of a pump brine, cooled by ice, from a reservoir through the thermostat slightly in excess of that necessary to maintain the temperature and to heat the thermostat with lamps.

*The range* 10° *to* 200°.—In this range up to 100° water or oil is used as the thermostatic liquid; above 100° C. oil is necessary but is objectionable in large thermostats, where the heat transference deteriorates after some time. The heating of the baths with lamps up to 100° is replaced by Backer heating elements above that temperature. The mercury toluene regulator is filled with mercury which is then displaced with toluene in such a way that the contacting mercury surface does not come into contact with the toluene. A skilled glass-blower is required to seal off the regulator. A steel point which can be used in place of platinum when a valve relay is used can be controlled by a screw thread on the head piece of the regulator. The relay circuit can also be used on a.c. provided that chattering of the relay points with the frequency of the supply is stopped by means of a 2μF. condenser connected across the windings.

The expansion liquid which is used to replace toluene above 100° is the fraction from kerosene between 230°–250° distilled in contact with mercury. This can be used up to 200° C. but distillation of the mercury up the stem of the regulator must be prevented by a baffle.

*The range* 200°–500° C.—An equimolecular mixture of $NaNO_3$ and $KNO_3$ in welded mild steel vessels is used as a thermostat liquid for accurate work or an air bath in which circulation is maintained by a fan. The regulation is obtained by a device depending on the changing resistance of a platinum thermometer.[4] A bridge circuit is used and the change in voltage across the bridge actuates a Weston Model 30 Relay, the points of which put a potential on the grid of the thermionic valve which is used as previously described as a primary relay. A very small movement of the contacts of the Weston relay and the correspondingly small pressure at contact involving a high contact resistance for a small temperature difference are sufficient to work the secondary relay when a thermionic valve is used. Sticking of the contacts inevitably occurs on the break, and to obviate this it was found to be essential to give the point a kick with an interrupted mechanism. This is most easily done by means of a neon lamp arranged to flash once every 15 seconds by means of a suitable capacity and resistance in the circuit. The primary of a small telephone transformer is connected up to this circuit, and the secondary is in series with the coil of the Weston relay. The temperature can be maintained constant in a nitrate

bath to 0·1° C. and in an air bath to 0·5° C. at 500° C.

*Range 500° to 1100° C.*—The same method of regulation is used, the resistance thermometer being in the form of two spirals in a Pythagoras sheath containing two bores.

*Constant temperature hut.* For maintaining a room at tropical temperatures and humidities a hut is used 15 ft. by 12 ft. by 19 ft., in which the heat is supplied by means of pipes along the walls, roof, and floor through which hot water flows. By this means the heat is supplied near these surfaces where it is being lost, and temperature gradients inside the room are reduced to a minimum. The temperature of the water is controlled by toluene regulators which actuate magnetically operated steam valves supplying steam to the circulating water. At a temperature of 40° C. it is possible to control to 0·25° C.

*Temperature measurement.*—From −200° C. to 1200° C. the standards used are carefully calibrated resistance thermometers. The circuit employed is the Kohlrausch method of "overlapping shunts" in which a differential galvanometer is required. This circuit is very sensitive and practical.

## DISCUSSION

Mr. E. J. Lush referred to the necessity of stringent temperature control in the process of catalytic hydrogenation.

Mr. A. R. Thomas described an alternative method of employing a thermionic valve relay in conjunction with a thermostat.

Dr. P. May suggested the use of liquid nitrogen instead of liquid air for low-temperature experiments, as being less likely to cause explosions when brought into contact with such materials as pentane; he also suggested the use of tri-cresyl phosphate instead of oil for immersion baths in the neighbourhood of 200° C.

The authors said they had no means of preparing liquid nitrogen, and thought that the probable corrosive action of tri-cresyl phosphate would outweigh its other advantages.

Mr. H. Bliss was particularly interested in the arrangement of the heating pipes in the air-conditioning room described by the authors. Was it not difficult to ensure the same temperature throughout, especially in view of the possibility of *radiant* heat being emitted by the pipes, as distinct from the heat transfer effected by air circulation?

The authors replied that as the water in the pipes was only slightly hotter than the air surrounding them, any radiation was reduced to a minimum.

The chairman said that contrary to the experience of the authors, he had found thermal junctions as reliable as resistance thermometers for temperature measurements under certain conditions.

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# INDUSTRIAL NOTES FROM EGYPT

Japan exports to Africa at the present time between 600,000 and 700,000 rush mats every year, which represents a quarter of the total production of the country. The news of the erection of a mat factory in Alexandria was not calculated to cheer the Japanese makers, who fear that the competition will be severe. Rushes for the purpose can be obtained in various parts of Egypt, but chiefly from marshy lands and the borders of the irrigation drains. As marshes are being filled in rapidly, the production of rushes tends to fall off, the more so as the land on which they have been grown is improved thereby, and landowners naturally turn to other and more remunerative crops. A committee has been set up to study the whole question from the industrial point of view, for it is obviously most desirable to encourage a local industry, and at the same time it is essential that the filling in of the marshes shall not be slowed down.

A decree has been published forbidding the sale of denatured alcohol of less than 90° strength. This is not clear, but presumably it means 90%, as a great deal of the denatured spirit on the local market has been heavily diluted with water in the past: the decree has long been wanted.

The Government is keen to encourage the local glass industry and to this end has established a model factory for training workers. It is hoped that after a period of training in the factory the men will be able to carry on their work either in small workshops or else in their own homes, and whilst it is recognized that they will not be able to make glassware for which expensive plant is required, it is hoped that they will be able to make the bracelets, ear rings, and other glass ornaments which are used so extensively by the native woman. To this end the training will tend in this direction first of all, so that the men may be able to make a living at their trade as soon as they leave the factory for their own homes.

Egypt uses large amounts of wool and the consumption is on the increase. The country has huge numbers of sheep, and for a long time the possibility of using the wool has been under examination. Trials have been made, but the experiments made in Egypt have shown only that the factories already established do not possess the plant requisite for really good work, and also that insufficient care is taken both of the animals and of the wool. Samples have been sent to Europe recently and the fabrics obtained therefrom have been of quite good quality. Everything depends upon the care which is given to the beasts before and after killing and skinning, as well as upon the factory equipment.

Egypt exports a great deal of phosphates to Japan, and recently the exports have gone up considerably, owing to the drop in sterling which has enabled Egyptian phosphate to compete successfully with the Florida product. Florida exporters, however, have come to an arrangement with the shipping

companies to transport phosphates at an extremely low rate. The disparity between this rate and that charged from Egypt covers practically the difference between the prices of the two products. It is not expected that the shipping companies will be able to maintain the low rates for long, and then Egyptian phosphates will score again.

The soap industry is one which has grown greatly in Egypt of recent years, and especially during the last eighteen months. This has been due, no doubt, to the reduction of customs duties on the oils imported for soap-making, and the raising of the duty on foreign soaps. The Department of Commerce and Industry has drafted regulations for the prevention of adulteration in which the main clauses provide for a fatty acid content of not less than 40%, the registration of the brand or trademark, the right of the Government to make test analyses, and the regulation of the issue of licences for manufacture. This is all to the good, for some of the locally-made soap has been of very poor quality, though there is some on the market of really excellent quality also.

Sesame is largely used in the local oil industry, but the quantity produced in the country is insufficient for the local consumption. Egypt is fourth in the list of the world's importers, and imports annually about 11,000 tons, which is twice the average annual internal production. Consumption is growing, and therefore it is hoped that it may be possible to extend the cultivation of the plant so as to reduce the amount which must be purchased abroad.

Before the Egyptian Institute recently a paper was read dealing with the discovery of a valuable tungsten deposit in the country. It lies in the desert in the district between Kena (about 40 miles north of Luxor) and the Red Sea in the mountain area. Analyses made of samples taken from near the surface and from the surface indicate that the ore is a very rich one indeed, and whilst one must wait for official confirmation of the figures which were given it appears that development of the deposit will prove very profitable for the country. The existence of the deposit was not entirely unknown before the authors of the paper in question found it, but commercial development had not been undertaken.

A British concern has informed the authorities that it is prepared to buy eggs up to a million a week provided that the supply is guaranteed by a serious Egyptian concern and that the quality is maintained satisfactorily. The proposal is being studied by one of the main Co-operative Societies in the provinces which will collect the eggs and deliver them to the works of the British firm in Port Said, if it undertakes the supply. Egyptian eggs are small, but of good quality and are produced in very large quantities. This will be a most valuable additional outlet for them.

# SOCIETY OF CHEMICAL INDUSTRY

## OFFICIAL NOTICES

**Road and Building Materials Group.** The Council has approved the formation of a new Subject Group having as its scope "The scientific study of all materials, processes, and methods either used or projected in the road and building industries, together with any other topics allied with or of interest to such studies." Approval was given at the same time to the draft rules submitted with the petition and to the following executive which may hold office till May 1935: *Chairman:* Prof. R. G. H. Clements. *Vice-Chairman:* F. M. Potter. *Hon. Secretary and Treasurer:* Dr. H. F. Gillbe, with a Committee composed of R. G. C. Batson, D. C. Broome, H. W. James, P. E. Spielmann, F. G. Turner, B. H. Wilsdon, D. M. Wilson, with power to add a maximum of 9 members.

The Group already has 76 members. All members of the Society are entitled to join without extra fee. Fuller particulars may be obtained from the Hon. Secretary, R. and B. M. Group, Society of Chemical Industry, 46, Finsbury Square, E.C.2.

### MEMBERS ELECTED

**December 15, 1933**

Aldrick, Maurice John, 6, Court Drive, Long Lane, Hillingdon, Middx. Technical representative.

Alexander, John, 3, Dormay Terrace, The Plain, Wandsworth, S.W.18. Chemist.

Attwooll, Alan Willby, The Limmer & Trinidad Lake Asphalt Co., Ltd., Victoria Wharf, Wandsworth Bridge Road, S.W.6. Chief chemist.

Bain, Thomas Miller, Cirolanum, Ltd., Gomersal Mills, Gomersal, near Leeds. Works chemist.

Balfe, Michael Philip, British Leather Manufacturers' Research Association, 20, St. Thomas' Street, S.E.1. Research chemist.

Barnell, Herbert Rex (Dr.), School of Agriculture, Cambridge University, Cambridge. Plant physiologist.

Batson, Reginald George Cyril, Road Research Laboratory, Harmondsworth, West Drayton, Middx. Chartered civil engineer.

Belsey, Stanley G., 30, Redhill Drive, Edgware, Middx. Highway engineer.

Bergmann, Ernst (Dr.), Daniel Chaim Sieff-Institute, Rethoboth, Palestine. Research chemist.

Bing, Jean, 5, Rue de Sfax, Paris, XVI. Engineer.

Brooks, John Edward, 28, Arlington Gardens, Chiswick, London, W.4. Works chemist.

Chalk, Leslie James, 52, Brunswick Road, Ealing, W.5. Chief chemist, Geochemical Laboratories.

Clarke, Granville Hubert, Western Margarine, Ltd., Western Avenue, Acton, W.3. Chief chemist.

Clements, Raymond George Hubert, Imperial College of Science, City and Guilds (Engineering) College, Department of Highway Engineering, Exhibition Road, S.W.7. Professor, University of London.

Clifford, Harold Miller, 24, Thornbury Avenue, Southampton. Manager, Limmer Trinidad Asphalt Co., Southern Area.

Faldo, Walter A. Kemp, 106, Salisbury House, London Wall, E.C.2. Asphalt contractor.

Fudge, G. Hamilton (*restored*), South Metropolitan Gas Co. (Chemical Dept.), 709, Old Kent Road, S.E.15. Chemist.

Gatehouse, Frank B., "Maristowe," Butts Green Road, Hornchurch, Romford, Essex. Chemist.

Gilbe, Henry Frank, 134, Melrose Avenue, Cricklewood, N.W.2.

Greaves, Clifford, Forest Products Laboratories, Isabella and Metcalfe Streets, Ottawa, Ont., Canada Chemist.

Gwillim, Gordon Maxfield, Coultersham Mill, Petworth, Sussex. Flour miller.

Hancock, George John, Terminal House, Grosvenor Gardens, Victoria, S.W.1. Secretary to The National Asphalt and Mineowners' Council.

Hobart, Floyd B. Battelle Memorial Institute, 505, King Avenue, Columbus, Ohio, U.S.A. Fuel chemist.

Hope, Vacey Vivian Lummington, 28, Fitzjames Avenue, London, W.14. Technical secretary to The Limmer & Trinidad Lake Asphalt Co., Ltd.

Johnston, J. H. E., c/o Messrs. Martin & Co., 12, Mission Row, Calcutta, India. Paint etc. technology.

Judd, Clifford William, British Dyestuffs Corporation, Ltd., Ellesmere Port Works, Ellesmere Port Cheshire. Technical chemist.

Knight, B. H. (Dr.), 35, Lincoln's Inn Fields, W.C.2. Tutor, College of Estate Management, private research worker.

McVeigh, Stuart Thompson, 534, Huron Street, Toronto, Ont., Canada.

Miller, Hugh, c/o Roads & Road Construction, 68/69, Shoe Lane, E.C.4. Editor.

Milner, Henry Brewer, 92, Victoria Street, S.W.1 Consulting petroleum technologist.

Misslin, Emil Edward (Dr.), Society of Chemical Industry in Basle, Library Dept., Basle, Switzerland. Chemist and manager.

Morton, R. M., Tilbury House, Petty France, S.W.1 Civil engineer.

Peck, W. C. (*restored*), 16, Dorcis Avenue, Bexley Heath, Kent.

Pickstone, Cornelius, 52, Sheals Crescent, Maidstone, Kent. Manager, "Fillers" Branch Tilbury, C. & D.C., Ltd.

Poole, Albert Gordon, 14, Park Avenue, Monkhams Avenue, Woodford Green, Essex. General manager.

Ross, James Hamilton, Forest Products Labs. of Canada, Pulp and Paper Division, 3420, University Street, Montreal, Que. Officer in charge.

Sands, Norman Bransby, 2, Mayfield Road, Halton, Leeds. Brewers' chemist.

Schofield, Walter John, Previte (*Trinidad Bitumen*), Ltd., Capel House, 54, New Broad Street, E.C.2. Chief engineer.

Sheppard, O. E., Montana State College, Bozeman, Montana, U.S.A. Professor.

Simeons, William Raymond, The British Gelatine Works, Ltd., New Bedford Road, Luton, Beds. Gelatine manufacturer.

Sims, E., 32, The Waldrons, Croydon, Surrey. Works manager, chief chemist.

Smith, Charles Clitsome, The Gas Light & Coke Co., Tar Works, Southall, Middx. Chemical engineer.

Smith, Clement Greville, "Sayesmore," Addlestone, Surrey. Technical assistant, Limmer & Trinidad Lake Asphalt Co., Ltd.

Spielmann, P. E. (Dr.), (*restored*), 9—11, Bloomsbury Square, W.C.1. Consulting chemist.

Stern, Ernst (Dr.), Industrial Engineering, Ltd., Bush House, Aldwych, W.C.2. Associated with the above company.

Thomas, A. R., 133, Cleveland Road, West Ealing, W.13. Technical manager, Hutchinson's Testing Office.

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Vaunan, Ebenezer, 64, Chipstead Street, Fulham, S.W.6. Technical chemist.

Vigor, Eric, 14, Carew Road, Wallington, Surrey. Manager, Neuchatel Asphalte Co., Ltd.

Winson, Edward G., Ellangowan, 8, St. Barnabas Road, Woodford Green. Works chemist.

Wolf, Alan, Oil Technology Dept., Royal School of Mines Section, Imperial College of Science and Technology, S.W.7. University lecturer in oil and asphalt technology.

Simon, J. F., Messrs. Goodall Backhouse & Co., 6, Sovereign Street, Leeds. Pharmaceutical chemist.

Sowler, James, c/o Messrs. Bell & Sons, Ltd., 96, Pall Mall, Liverpool. Chemist.

### ASSOCIATE MEMBERS

Cunningham, H. H., 52, Endborne Road, Orrell Park, Aintree, Liverpool. Chemist.

Drasin, G. F., 311, Thompson Street, Ann Arbor, Michigan, U.S.A. Student (chemical engineering).

Kellog, H. B., 32—40, 103rd Street, Corona, Long Island, New York, U.S.A. Analytical chemist.

Kinniburgh, W., 5, Watt Street, Greenock, Renfrewshire. Chemist.

Maiden, A. M. (Dr.), c/o British Arkady Co., Ltd., Skerton Road, Old Trafford, Manchester. Research chemist.

Martin, H. C., 306, Wyandotte Street, Bethlehem, Pa., U.S.A. Student.

Mercer, D., 16, Hale Road, Wallasey, Cheshire. Student.

Noble, J., 62, Lynwood Road, Orrell Park, Liverpool 9. Schoolmaster.

Swift, S. R., 41, Albion Street, Wallasey, Cheshire. Student.

Terleski, J. T., Oakwood, Hilton Lane, Prestwich, near Manchester. Student.

Wiltshire, W. A., 21, Torver Road, Harrow, Middx. Laboratory assistant.

## LIVERPOOL SECTION

There was a large attendance at the meeting of the Liverpool Section which was held on Friday, December 8, in the University of Liverpool, Mr. E. Gabriel Jones in the chair.

A lecture entitled "The Mechanization of Research" was delivered by Major F. A. Freeth, O.B.E., D.Sc., F.R.S., joint research manager of Imperial Chemical Industries, Ltd., in the course of which he said:

You will observe that the title of this lecture does not say whether I am for or against mechanization. The answer is, I think, that a good deal of mechanization is inevitable in modern life. What ought one to mean by mechanization? I suppose that mechanization at its highest consists in getting a large number of routine jobs done and done rapidly and, above all, accurately. It is inevitable that in modern

...ndustrial and even scientific life there are a very large number of problems in conjunction with anything new which will arise at once to the mind of every intelligent man who is concerned with it. Let me give you some examples drawn from past history.

In the war, I, together with many others, was concerned with the manufacture of certain forms of high explosives, notably that potent auxiliary, ammonium nitrate. The usual procedure had been to take sodium nitrate and to treat it with sulphuric acid for the manufacture of nitric acid, which could then be used for the production of explosives. It soon became evident that the supplies of sulphuric acid to do this were not available, therefore it was suggested that ammonium nitrate might be made by a double decomposition of fixed ammonium salts such as ammonium sulphate. This presents a difficult problem but by an extraordinary piece of good fortune my colleague Cocksedge, who is now head of research of I.C.I. (Alkali), Ltd., and I had worked out in very fair detail a large number of the necessary equilibria for such processes. This is where we come to the mechanization of research. Most of the setbacks which we had, and they were many, were due to the fact that we had not really done quite enough formal work, and when we had completed the formal work we were in the following position. We were like men who had a reliable map of the country and knew our way about. If we had not had the map we might have succeeded by sheer empirical methods, but would not have had the faith behind us which carried us through.

There are any number of similar problems connected with both academic and industrial research, and it is inevitable in the present state of science that so-called research must in many cases be of rather a mechanized nature. It is not difficult to point out some considerable gaps in the existing way of going about things: I am referring particularly to experimental facilities and if I may say so, it is in this respect that academic science had got a good deal to learn from industry. Every research department of any scale ought to be able to command the reasonable variables of nature so easily that it should be taken for granted. By the reasonable variables of nature are meant temperatures of from, say, 50 absolute to 2000° C., pressures from black vacuum up to, say, 5000 atmospheres, together with mechanical facilities which would enable a research worker to overcome his difficulties. There are not many laboratories in this country that can do this. Let us take some specific examples. Every Research Department should possess the following facilities: (1) A reasonable supply of first-class glass blowers; (2) fine mechanics capable of making any reasonable scientific instrument of a new type; (3) adequately fitted engineering shops under the direct control of the Research Department: (4) ample supply of liquid air.

If any of my audience doubt this, let them put themselves in the place of a young research worker who for some reason or other wishes to work with an iron-nickel alloy with a considerable percentage of nickel. If he has not convenient access to a good induction furnace, he will probably have to attempt to make his alloy in an ordinary furnace. This, on the smallest scale, is intensely difficult, nearly heart-breaking. If, on the other hand, he has access to an induction furnace, he can make any alloy he likes within a few minutes, and after a little practice, of an accurate composition. Similar remarks apply to a good supply of liquid air. It is all very well to say that you can telephone for it, but you will find in practice that the average young man is very chary about worrying his superiors in this way. Having everything on the spot is half the battle. By the mechanization of all the services of a laboratory you can not only save the time of your men and increase their output, but save them from mental worry also.

What are the dangers of mechanization of research? The answer is, the danger of mechanizing the minds of your research workers. There is a tremendous difference between research and discovery. Discovery is a very fickle thing and inventiveness may occur in the minds of anyone, irrespective of training or not.

There are two ways in going about research: one is to read everything and the other is to read nothing at all. If you read everything, you must be very wary indeed as to how to exercise your critical faculties in summing up the work. There is, unfortunately, a tremendous amount of rubbish published and if you do not agree with the conclusions of any author and you think you have any reasonable grounds to do so, I should strongly advise you to go after your doubts. It can hardly be questioned but that a lot of discovery is missed owing to the fact that people accept far too readily what has already been done. That is what I mean by mechanizing the mind of the research worker, which is all to the bad. There is another kind of mechanizing which is not good, and that is the increasing amount of administration which takes place in life, especially in England during the later life of anyone. If you look around you at the successful men in modern life, you will see very very few of them in paid positions who work with their hands. It is impossible to blame anyone for drifting towards administration, because that is where success will generally lie, and every reasonable person wishes to be successful. Nevertheless, it should be realized by those in authority that in certain cases a man who does an experiment or observes it, sees things that the more mechanically-minded might not, and every effort should be made to enable these people, who by means of their ability, have risen to a high position, actually to see the conduct of the experiment themselves. What happens in practice is that people fall back on abstracts which they read themselves, or even go so far as to have an abstractor who puts the facts in front of them. This is all very well in its way, but I would earnestly put it to you that in most cases it is far better to read the original work of the people who you think are the best on the subject,

than to clutter oneself up with a lot of abstracts, the reason being that if you read the original paper, details of the experiment and follow the diagrams and the general trend of the paper, it will do what every paper ought to do to you, that is, set your ideas going.

The greatest attention should be paid to the ideas of people, even if they are laymen who are experimentally minded. This applies, as you all know, with the greatest force to engineering. All sorts of people are mechanically-minded and mechanically-minded non-engineering people have made and are still making discoveries.

Finally, far more attention should be given to the historical side of discovery. Young men should remember that if they wish to avoid the mechanization of their own minds they would be very well advised to read the history of the particular subject in which they are interested, by following up all papers, especially if they have been written by great men. Finally, it is a good thing to remember that the habits of thought in this country are very different from those of any other. There is a tremendous tendency in this country to do everything on traditional lines—this makes us probably the most stable nation in the world.

At the conclusion of the lecture a discussion took place to which the chairman, Prof. E. C. C. Baly Dr. R. A. Morton, Prof. T. P. Hilditch, and Mr. H. E Potts contributed.

On the motion of the chairman a very cordial vote of thanks was accorded to the lecturer.

## NEWCASTLE SECTION

A joint meeting with the Institute of Chemistry was held on Friday, December 15, in Armstrong College, with Prof. Clemo in the chair. Mr. W. Singleton of the Research Laboratories of Goodlass Wall & Lead Industries, Ltd. read a paper on "Recent Developments in Lead for Chemical Plant." This was mostly concerned with the superiority of lead containing a maximum of 0·1% tellurium over ordinary pure "chemical" lead. This superiority lies in mechanical rather than chemical properties, although resistance to corrosion is, in general, also increased. Failure of lead in service is often due to intercrystalline cracking rather than to corrosion, and this is traceable to the variability in grain size, recrystallization, and crystal growth at ordinary temperatures, which are much enhanced by rise of temperature, by strain, or by vibration. The tellurium lead has a very much smaller and more uniform grain size, and the causes of failure mentioned are largely inhibited in it. During the discussion which followed Prof. Riley brought up the question of tellurium supply, which subject he had had occasion to look into. It is derived exclusively from the refining of other metals, notably electrolytic copper, as its own ores are rare minerals, and he estimated maximum production at about 100 tons per annum, which would serve for treatment of 224,000 tons of lead only. The lecturer did not anticipate any shortage, however. Mr. D. W. Jones mentioned the importance of the lead industry on Tyneside, and gave support to the claims for the new material.

The thanks of the meeting were expressed by Mr. B. P. Hill.

## NOTTINGHAM SECTION

A joint meeting of the Nottingham Section with the members of the Institute of Fuel was held at the University College, Shakespeare Street, Nottingham, on *Thursday*, November 23. *Mr. Anderson, chairman* of the Section, presided. Copies of a paper on "The Manufacture and Sale of Open-grate Coke," by Dr. G. E. Foxwell and Mr. John Roberts had been circulated to all interested, and following brief comments on the main points of the paper by the authors, the remainder of the time was devoted to discussion. The audience was strongly representative of all the branches of fuel industry and research.

The authors introduced the term "open-grate coke" to describe any free-burning coke suitable for use in the open fire grate as distinguished from the usual solid smokeless fuel produced in coke ovens and gas works which was generally suitable under conditions where there was more draught than in the ordinary open fire grate, and stressed the point that such fuel should be as good as coal in every respect and not "nearly as good." Also, more attention would have to be paid to the "saleability" of the product, an aspect which had been largely neglected hitherto. The fuel should be available at all times and satisfactory to the user as regards important features, *e.g.*, freedom from ash (especially flying ash particles), ease of ignition, combustibility, and cleanliness. Also, quality should be uniform as between one delivery and the next. The cost of production should be reduced so that open-grate coke could be sold at a price at which it could compete with house coal. The authors then instanced a number of methods in detail which promised to satisfy the above requirements. Hundreds of processes for making smokeless fuel had been patented and the authors thought that to prevent the present confusion becoming worse a simple solution should be sought.

Data were given showing the conditions of heating and temperature necessary when using various coals for producing a tar-free fuel, sufficiently dense, not over graphitized and therefore easily ignited. Other technical details, including pre-carbonization treatment (blending etc.), effect of coking time and adaptation of the process to various types of retorts were included, and attention was drawn to the possibilities of gas retorts as sources of supply. In conclusion, reference was made to the need of combined marketing and standardization of the product.

During the discussion which followed, Mr. Dawe read a commentary on the paper by Dr. J. G. King of the Fuel Research Station.

Other speakers included Mr. Anderson, who asked whether it was possible for a central-heating apparatus

to be devised for houses, which would burn the coal and give coke which would be suitable for burning in open grates.

Mr. Calam thought that the possibilities of smokeless fuel had not been properly brought to the attention of the public as possible consumers, and also that one needed assurance that the ordinary types of domestic fire-places were suitable for smokeless fuel.

Mr. Gill thought that the gas industry should further develop the manufacture of gas which could be used for heating the retorts and so make more coke available for the market.

Messrs. Britton and Gill and Dr. E. W. Smith dealt with the various technical aspects raised.

Mr. Dixon, manager of the Nottingham Gas Works, pointed out the importance of educating the public in the use of smokeless fuel as the majority of users were not burning the right type for their particular heating apparatus. Nottingham was training special men to call on users of smokeless fuel to give instruction and advice.

Dr. Whittaker thought the authors might have given more attention to burning coal properly, that is, without smoke. He did not think this was impossible. The authors replied carefully to all the points raised in the discussion.

Mr. Anderson, in moving a vote of thanks, which was seconded by Mr. Dawe, said that the authors had stated the problem very clearly and stimulated one of the best discussions which had ever taken place before the Nottingham Section.

## INSTITUTION OF CHEMICAL ENGINEERS

The problem of the corrosion and protection of magnesium and its alloys was the subject of a paper read at a meeting of the Institution of Chemical Engineers in London on Friday, December 8. Mr. W. A. S. Calder took the chair in the absence of the President, Lord Leverhulme, and the authors were Dr. Guy D. Bengough and Mr. L. Whitby. Dr. Bengough is well known as having worked in the field of corrosion research for many years, and the importance of the work now being done in regard to magnesium has special application to aircraft construction, as well as to motor parts. The subject was treated from the point of view of atmospheric corrosion and sea-water corrosion, and it was pointed out that dry air at laboratory temperatures has little or no action on massive magnesium, but the rate of attack slowly increases as humidity rises to about 90% of saturation, when a rapid increase occurs. Magnesium hydroxide is first formed and adheres to the metal, but this layer is granular and does not at once form a protective film. This may seem surprising when it is remembered that corrosion is rapidly stifled in both distilled water and caustic alkalis; the explanation suggested by the authors is that atmospheric action is a direct attack by water vapour and is not electro-chemical, and it probably gives rise to a physically different corrosion product.

A particularly interesting feature of the experimental work described in the paper is that it shows that no permanently protective film is formed on magnesium by exposure to an outdoor atmosphere; even in dry periods a slow increase of weight occurs, which is generally followed by a decrease in rainy periods.

The presence of sea-water spray in the atmosphere greatly increases corrosion, and quite new factors come into play, since the alloys may be wetted with an aggressive chloride-bearing electrolyte. The factors which control the corrosion rate of magnesium have been found to be different from those of most industrial metals because the whole corrosion process consists of hydrogen-gas displacement. An important factor is the potential difference across the active electro-chemical corrosion cells, which may be of the types metal film, metal/re-deposited metal, or metal/impurity. Owing to the relatively low hydrogen over-potential of magnesium, either bare or when covered with films of certain corrosion products, the attack can proceed at considerable speeds in alkali chlorides even when the metal is highly purified and contains no more than say, 0·02% of total metallic impurity. However, traces of certain metals, such as 0·01% to 0·03% of manganese, may cause considerable increases in the rate, though much larger amounts, say 2% of this metal, may cut it down. In dilute hydrochloric acid the effects of traces of metallic impurities surprisingly disappear, and since no films of corrosion product are formed in this reagent, an explanation is suggested as likely to be found in the effect of the impurities upon the films which dictate the potentials of the corrosion cells in salt solutions.

The effect of corrosion on the mechanical properties of magnesium and magnesium alloys was dealt with at some length, and this was followed by a section in which protection processes for magnesium alloys were discussed. It is pointed out that it is easy to produce protective films on light alloys of magnesium owing to the high reactivity of the metal, but very few of them are of any value. The authors have tested in a preliminary way the effects produced in more than 500 different solutions, and the alum-dichromate and the selenium processes are the residue after drastic elimination. The former has been tested on a large scale in the Royal Aircraft Establishment, and although both processes have some claim to consideration, the authors consider the possibility of the discovery of rival, and even improved, processes is still considerable. In practice the value of these processes will probably depend on their behaviour as bases for paints, but unless a paint can retain its power for long periods, it has little value for magnesium alloys, since the evolution of hydrogen beneath porous areas leads to blistering and stripping. Because of its value in resisting inland atmospheric attack, lanoline has been included

in the tests carried out by the authors, but the results suggest that it is not always so impermeable as is generally assumed.

Inasmuch as one of the uses proposed for light magnesium alloys is for deck fittings of destroyers and other craft where lightness is important, it is essential that any protection process must be adequate to resist the results of temporary immersion in sea water. The results of tests show that none of the chemically produced coatings hitherto tested was likely to afford useful protection against prolonged immersion in sea water. It was thought, however, that some paints might do so, and tests indicated that the best results were obtained with either thermoprene resin or sulphur-treated oil pigmented with zinc chromate. The next step was to obtain increased protection by the use of a top coating. As the thermoprene resin did not take a top coating well, sulphur-treated oil and a quick drying tung oil base medium were used, both pigmented with zinc chromate. The tung-oil medium had the advantage of quicker drying, since the process took only a few hours. Zinc oxide as a pigment shows up best. The superiority of cellulose to other top coatings was not so marked generally as it was in the spray tests, in which it was decidedly best. Other tests on paints were mentioned, and the authors admitted that they might be criticized because they were conducted on small specimens. This, they said, was necessary because of the high cost of the alloys. It was only claimed that the tests recorded in the paper in this connexion were a useful preliminary exploration of a field which would require much further cultivation.

There was a useful discussion on the paper, which was taken part in by manufacturers and representatives of the Royal Aircraft Establishment and the National Physical Laboratory.

The Chairman expressed his disappointment with the results in the paper relating to the use of rubber products as protective coatings and added that a considerable amount of work in this direction was being done elsewhere.

Mr. J. E. Haygarth (National Physical Laboratory) criticized the solution used by the authors which only contained 15% of lanoline in benzene, and said this gave too thin a film to be efficiently protective. He also urged the need for careful analysis of the lanoline for freedom from moisture and low fatty acid and ash content.

Dr. H. Sutton (Royal Aircraft Establishment) said work done at Farnborough had led to the use of zinc chromate as a pigment in enamels and paints for protecting magnesium alloys. Cellulose top coats had also been used with success on aircraft parts, whilst coatings containing zinc oxide as pigments had, in general, been found to give rather better results than those containing aluminium powder as pigments. An important practical disadvantage of the selenium treatment was that enamelled or painted pieces developed blisters on exposure to atmospheric or marine conditions. It had also been found at Farnborough in tests on blended fuels—petrol and lead tetraethyl—that serious corrosive effects occurred in the presence of water and the selenium treatment had not proved very effective in this respect. He also complained of the smell from parts treated with selenium.

Mr. Whitby replied that if the paint or enamel was good there should be no smell, and he pointed to certain examples exhibited to bear out this statement.

Col. L. M. Wilson (British Maxium, Ltd.) expressed the hope that the paper and discussion would not give the impression that corrosion and magnesium were synonymous, because they were not. Under normal conditions, magnesium resisted corrosion very much better than steel.

Mr. G. W. Lacey (Birmingham Aluminium Casting Co., Ltd.) referred to painting aluminium-magnesium alloy for boat building—in which his firm specialized—and said trouble from peeling and blistering had been overcome by putting an intermediate coat of aluminium pigmented varnish before adding the final coat.

Dr. J. O. Cutter (Paint Research Association) remarked that although paints and enamels had been condemned, it was possible to use them satisfactorily if only the paint system adopted was studied carefully in all its bearings. The authors' experiments were on too small a scale, in his opinion, for any definite conclusions on this matter to be drawn.

Mr. H. Goodwin (Sterling Metals, Ltd.) remarked that although the paper hinted that the cost of magnesium was too high to permit of the authors using large specimens, the manufacturers would be willing to co-operate in any future work and provide specimens.

Dr. A. J. V. Underwood suggested that if a magnesium was obtained on the surface of which some oxide had formed, and then it was treated with magnesium chloride to form a magnesium oxychloride cement as a protective layer, this should serve the better to exclude air.

The authors were sincerely thanked for their paper at the conclusion of the discussion.

## SOCIETY OF PUBLIC ANALYSTS

An ordinary meeting of the society was held at the Chemical Society's rooms, Burlington House, on Wednesday, December 6, the President, Mr. F. W. F. Arnaud, in the chair.

Certificates were read in favour of S. Emsley, G. F. Hall, W. M. Keightley, D. M. Mathews, R. P. Page, H. M. Perry, A. D. Powell, and W. E. Smith.

The following were elected members of the society: W. E. Baier, A. Dunsmore, D. C. Garratt, C. J. Regan, R. H. Slater.

The following papers were read and discussed:

"A Specific Gravity Apparatus," by C. H. Cribb.—A specific gravity bottle, devised by the late C. H. Cribb, was demonstrated by T. McLachlan. In

order to avoid the necessity for a water-bath with thermostatic control, the bottle, which has a thermometer stopper, is provided with a glass bulb sufficiently heavy to sink in any ordinary fluid and having a diameter about twice that of the neck of the bottle. With this addition the adjustment of temperature can be made to within a tenth of a degree in the course of a few minutes.

"The Excretion of Aloes," by G. F. Hall and W. M. Keightley.—Applying their modification of the Schoutelen reaction, the authors have shown that it is possible in some cases to detect unhydrolyzed aloin in the urine for periods up to 60 hours after the aloes have been taken. The unhydrolyzed material can be detected at a later period than the hydrolyzed drug, since the Schoutelen test is more sensitive than the Bornträger test (for the hydrolyzed drug).

"The Chemical Examination of Furs in Relation to Dermatitis. Part IV," by H. E. Cox.—A quantitative study of the oxidation of *p*-phenylenediamine by hydrogen peroxide in the presence of fur shows that the principal pigment formed is an azine combined with the fur proteins. Some Bandrowski's base is found on the surface of the fibres, and there exists in the solution in the dye bath much free *p*-phenylenediamine unoxidized, together with some Bandrowski's base and traces of quinone and ammonia. Similar data are given in respect of *p*-aminophenol, which forms an oxazine in an analogous manner. The azine from *p*-phenylenediamine forms a leuco compound with the addition of only 0·18% of hydrogen by action of titanous chloride; it can be formed by direct oxidation of Bandrowski's base in solution, and has at least nine benzene rings in its constitution.

A preliminary account is given of the reaction of Bandrowski's base with dilute hydrochloric acid, whereby free *p*-phenylenediamine is formed. This base is not, as has usually been assumed, the desired product in fur dyeing. The occurrence and properties of the intermediate oxidation products in relation to dermatitis are discussed.

"The Use of the Air-Damped Balance for the Determination of Total Solids in Milk," by John Golding.—Very rapid determinations of milk solids can be made by evaporating about 1 g. of the milk in an aluminium cap (which cools very rapidly) and weighing the residue on an air-damped prismatic reflecting balance (Oertling). The influence of the time of drying on the results is shown in a series of tables.

"A Rapid Method of Determining Minute Quantities of Nitrites," by G. G. Rao and K. M. Pandalai.—An iodimetric method has been devised in which the iodine liberated by the interaction of nitrous acid and hydrogen iodide is titrated in the presence of carbon dioxide evolved within the liquid itself. This prevents oxidation of the nitric oxide, also formed in the reaction, and expels it from the system, thereby eliminating the action of the resulting nitrogen peroxide on the iodide.

# CORRESPONDENCE

## METRIC UNITS OF VOLUME

SIR,—In response to your request of September 29 may I express my feelings regarding the use of ml. and c.c.? When reading the *British Pharmacopœia* the former term always causes an unpleasant sensation, whilst the only practical disadvantages of c.c. appear to be the slightly greater space it occupies in print and the fondness of Indian clerks for writing it cc. It must be remembered that the difference between the cubic centimetre and the millilitre is less than 3 parts in 100,000, a quantity of small significance to the average chemist even when atomic weights are concerned, and thus it would seem that the choice is largely a matter of sentiment.

A centimetre is a primary standard with the appearance of which most of us are familiar. In estimating the volume of a vessel we mentally measure it and calculate its size, we do not guess how much water it would hold, although the weighing method may prove convenient in practice. Some of us estimate volumes by determining how much gas they contain or even by weighing mercury the density of which is usually given in tables as grams per c.c. For those who deal with small quantities the cubic millimetre is a useful and easily visualized unit; must we call this henceforth a microlitre or µl. to the confusion of our local typists and printers?

I am impelled to write these lines by an "explanation" for the change given in the *Proceedings* of the Institute of Chemistry which has just reached me. The author suggests that the statement "1 c.c. of water weighs 1 gramme" is unquestioningly accepted and thus a chemist weighing water in air at room temperature may make large errors. I hope no reputable chemist would accept the statement, but should one be so debased, what is to prevent him when familiarity has bred contempt or carelessness, from defining the litre as the volume of a kilogramme of water and committing a similar error? After all, a cubic centimetre is a definite volume even if it be called a "c.c." and if confusion is to arise it is more likely to do so over the litre with its somewhat complicated definition. I hope therefore that CHEMISTRY AND INDUSTRY will think at least twice before abandoning the old familiar symbol.

I am, Sir, etc.,
H. E. WATSON

Bangalore.
India
Nov. 30, 1933

## UNDER-LOAD REFRACTORINESS OF FIREBRICK

SIR,—On page 1018 of CHEMISTRY AND INDUSTRY of December 15, in a summary of papers read at a recent meeting of the Ceramic Society, Mr. C. Edwards is reported to have stated that "the average English or Scotch firebrick, under a load of 25—50 lb. per sq. in., commences to collapse at as low as 1250° C., though it is often stated that they will withstand 1400° C. under such loads."

The user of firebricks might be influenced by this statement to assume that unjustifiable claims were commonly made for the refractoriness-under-load of firebricks. I do not find this justified by my experience and can state positively that very large quantities of Scotch firebricks, classified as of "good quality," are regularly being sold which will withstand 1450° C. under such loads, whilst 1500° C. can be guaranteed for selected bricks, if desired, by one firm. I should be surprised if even this were exceptional.

I am, Sir, etc.,
STANLEY HIND

Stoke-on-Trent
Dec. 16, 1933

# PERSONAL AND OTHER ITEMS

Dr. J. E. Myers, who has been on the staff of the Manchester University since 1912, has been appointed as Senior Tutor, and Assistant to the Vice-Chancellor. Dr. Myers will continue to perform his duties in the Department of Chemistry and in the various administrative posts which he holds at present.

## Derby Chemists' Joint Committee

A meeting of this committee, which represents the British Association of Chemists, the Institute of Chemistry, the Society of Chemical Industry, and the Society of Dyers and Colourists, was held in the Derby Technical College on December 12. Mr. R. A. Burrows, M.A. gave a lecture on "The Outlook in Europe."

He said that the Versailles Treaty, which gave Europe a peace that was dictated and not negotiated, had left a number of problems. The Polish Corridor was a danger spot, and the post-war arrangement of frontiers in the Balkans and elsewhere was admittedly unjust. He did not think that there could be any agreement on rearrangement of national frontiers.

Hitler, continued the lecturer, had started a movement of aggressive nationalism which would ultimately challenge the Treaty of Versailles. But Germany had to find an ally before she could go forward. Hitler was driving Germany out of the League because he did not believe in parliamentary government nationally or internationally. Perhaps he really wanted peace, but on the German condition of "parity of armaments."

Europe, said Mr. Burrows, was waiting for something to turn up, and possibly hoping it would not. Economic recovery might lead to states growing richer and thinking again of armaments.

The meeting was the second of the committee's activities during the month, a very successful dance having been held in King's Café, Derby, on Dec. 1.

## Importation of Dyestuffs

In accordance with the recommendations of the Import Duties Advisory Committee, the Board of Trade is issuing an open general licence under the Dyestuffs (Import Regulation) Act, 1920, with effect from December 27, authorising the importation of compounds, preparations and articles, not suitable for use in dyeing, manufactured from synthetic organic dyestuffs (including pigment dyestuffs) whether soluble or insoluble.

The Treasury, acting on other recommendations of the Committee, has issued Orders under the Import Duties Act, one providing for the addition to the free list of synthetic organic dyestuffs, and another imposing an additional duty of 10% on pigments which are synthetic organic colours and colouring matters. When these Orders are in operation the goods which will remain subject to prohibition (other than intermediate products) will, when licensed for importation, be free from payment of import duty, and in general other goods manufactured from synthetic organic dyestuffs will be subject to additional duties.

## Parliamentary Notes

The President of the Board of Trade presented on Dec. 13 a Bill to amend and make permanent the Dyestuffs (Import Regulation) Act, 1920.

A private member was given leave to introduce a Bill to prohibit the importation of foreign-made goods unless the exporter could satisfy a Customs' official that they were not to be offered for sale at a price lower than their market or selling price in the country of origin.

The Parliamentary Secretary to the Board of Trade stated, in reply to a question, that according to "The Lancashire Textile Industry," published in April, 1933, the total number of looms installed in the Lancashire cotton mills was 601,750, the corresponding figure for 1930 being 703,878.

## Canadian Coal Combine Case

Five coal companies operating in the Province of Quebec were recently found guilty of having offended against Canadian company law by banding themselves together in restraint of trade, and were heavily fined. The judge held that the companies had used agreements with Amalgamated Anthracite Colleries and with Montreal importers of British and American coal for the purpose of keeping up the prices of coal in Quebec, and that the first of these agreements should be declared illegal. He considered that increased imports of coal from Wales and Scotland had been beneficial to Canada.

## Institute of Brewing

By invitation of the North-Eastern Section of the Institute of Brewing, members of the Yorkshire Section of the Society of Chemical Industry attended a meeting held in the Queen's Hotel, Leeds, on Thursday evening, December 7, when Prof. N. M. Comber delivered a lecture on "Soil Reaction and Plant Growth." During the protracted and interesting discussion which followed, Mr. H. J. Hodsman, hon. secretary of the Yorkshire Section, expressed the thanks of the members of the Yorkshire Section for the invitation extended to them.

# COMPANY NEWS

## BRITISH BENZOL & COAL DISTILLATION, LTD.

During the year ended October 31 this company's trading profit was £4692, against a loss of £5393 in 1931—2. The net loss was £13,932, making a total debit of £79,516 to go forward. The average output of the plant was 64%, against 56%; it was seriously lowered early in 1933 owing to a colliery stoppage, and reached 80% in October. The demand for coke by the iron and steel industry is now increasing and it is considered that prospects for the present financial year are hopeful.

## LOW TEMPERATURE CARBONISATION, LTD.

During the year ended October 31 receipts were 23% above those of the previous year, and net profit of the company was £13,456, against £15,139, so that last year's debit balance of £5908 has been converted into a credit balance of £7548.

Sales of "Coalite" during the present winter have established a record, and distribution methods have been improved. The company has made considerable progress in the production of petrol and fuel oil from coal and is arranging to increase its output of the latter.

At the annual meeting the chairman referred to the rapid growth of the company's business in the last few years, and expressed the opinion that there was room for further great expansion. To finance further works an issue of 3 million 2s. ordinary shares would be made, these being offered in the first instance to existing shareholders.

## SULPHIDE CORPORATION

During the year ended June 30 the Corporation made a net profit of £37,817, compared with a net loss of £55,844 for the previous year. The Central Mine, previously closed, worked at full capacity during the year, and production at Cople Creek was increased. Owing to continuing low prices of metals, it has been decided not to resume dividend payments at present. Australian assets and liabilities are reckoned at par of exchange, but the difference between this valuation and that based on the current exchange rate is covered by certain specific reserves of the Corporation.

## DORMAN LONG & CO., LTD.

The company announces that it is seeking a moratorium until March 31, 1934, in respect of its 5½% debenture stock. Satisfactory arrangements to cover this period have been made with the company's bankers. It is emphasized that the proposed arrangements in no way affect the rights of the trade creditors of the company.

Consideration of the scheme for amalgamation with the South Durham Steel & Iron Co. (reported in Chem. & Ind., July 28, p. 620) has therefore been deferred for the present.

# MARKET REPORT

This Market Report is compiled from special information received from the manufacturers concerned.

*Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.*

The following alterations in prices are reported since the publication of the last Market Report (cf. Chem. & Ind., Dec. 1, 1933, p. 974).

### TAR PRODUCTS

Acid Carbolic.—Crystals, 8¼d.–8½d. per lb. Crude 60's, 2s. 5d.–2s. 6d. per gal.

Acid Cresylic, 99/100.—1s. 8d.–2s. 3d. per gal. Refined, 1s. 10d.–2s. per gal. Pale, 98%, 1s. 6d.–1s. 7d. per gal.

Pyridine.—90/140.—5s.–5s. 9d. per gal. 90/180, 2s.–2s. 3d. per gal.

### PHARMACEUTICAL AND PHOTOGRAPHIC MATERIALS

Paraldehyde.—1s. 1d. per lb., in demijohns.

Sod. Sulphite anhydrous.—£23–£25 per ton, according to quantity, d/d U.K.

### ESSENTIAL OILS

Almond.—Foreign S.P.A., 9s. per lb. Anise 2s. 1d. per lb. Bergamot, 7s. per lb. Bourbon Geranium, 23s. per lb.

Camphor.—Brown, 75s. per cwt. White, 95s. per cwt. Cananga, Java, 8s. 6d. per lb. Cinnamon Oil, Ceylon, 3s. 3d. per lb. Cassia, 80/85%, 4s. 3d. per lb.

Citronella Oil.—Java, 2s. 1d. per lb. Ceylon, 1s. 10d. per lb. Clove.—90/92%, English, 4s. 3d. per lb.

Eucalyptus, Australian B.P., 70/75%.—1s. 2d. per lb. Lavender.—Mont Blanc, 38/40%.—17s. per lb. Lemon.—5s. per lb. Lemongrass, 4s. 6d. per lb. Orange, Sweet.—4s. 6d. per lb. Otto of Rose, Anatolian, 33s. per oz.; Bulgarian, 45s. per oz. Palma Rosa, 7s. per lb.

Peppermint.—Japanese, 3s. 9d. per lb. Wayne County, 12s. 6d. per lb. Petitgrain 1s. 3d. per lb.

Sandalwood, Mysore.—30s. per lb. 90/92%, 19s. per lb. Australian, B.P. and French Codex, 92/95%, 15s. 6d. per lb.

# PATENT LIST

The following is a list of complete specifications of chemical interest which are open for inspection under Section 91 (4) (a) of the Patent Acts. Printed copies are not available, but photographic copies may be obtained at a charge of 8d. per page (minimum 1s.) from the Patent Office, Chancery Lane, W.C.2.

I. 20,601 (1932). Ateliers J. Hanrez. Apparatus for washing and purifying gases.

4377 (1933). Zollinger. Decantation apparatus and methods.

15,912 (1933). Mathieson Alkali Works. *See* VII.

II. 20,601 (1932). Ateliers J. Hanrez. *See* I.

15,040 (1933). Vooys. Flotation process for the wet concentration of coal.

III. 14,842 (1933). Consort. f. Elektrochem. Ind. Preparing oxalic acid.

15,289 (1933). Hene. *See* VII.

15,523 (1933). Du Pont de Nemours & Co. *See* VI.

15,864 (1933). I. G. Farbenind. *See* XIII.

15,896 (1933). I. G. Farbenind. Manufacture of compounds of the diphenylaminesulphone series.

**IV** 12,946–8 (1933). Sander. *See* XIII.

15,494 (1933). I. G. Farbenind. Manufacture of dyestuffs of the triarylmethane series.

16,234 (1933). I. G. Farbenind. Manufacture of oxazine dyestuffs.

**V.** 15,891 (1933). Brit. Celanese, Ltd. Opening staple fibres.

16,029 (1933). Du Pont de Nemours & Co. Manufacture of cellulose ethers.

**VI** 14,891 (1933). Soc. Chem. Ind. in Basle. Dyeing bone or objects made therefrom.

15,523 (1933). Du Pont de Nemours & Co. Manufacture of wetting agents and like substances.

15,862 (1933). Soc. Chem. Ind. in Basle. Dyeing furs.

15,878 (1933). Sylvania Industrial Corp. Moisture-proofing and moisture-proofed materials.

15,995 (1933). Pennel and Flipo. *See* XIV.

**VII.** 14,446 (1933). Phosphate Recovery Corp. Concentrating phosphate-bearing materials.

14,842 (1933). Consort. f. Elektrochem. Ind. *See* III.

15,289 (1933). Hene. Making potassium oxalate from potassium formate.

15,301 (1933). Lonza Elektricitätswerke u. Chem. Fabr. Production of concentrated nitric acid.

15,912 (1933). Mathieson Alkali Works. Chemical manufacture.

**VIII.** 14,475 (1933). Siemens & Halske A.-G. Material for polishing, smoothing, and grinding hard alloys etc.

14,785 (1933). Rohm & Haas Co. Laminated glass.

**IX.** 15,733 (1933). Uranschek. Manufacturing highly-porous fireproof insulating and building material.

**X.** 30,661 (1932). Deuts. Edelstahlwerke and Kruppa. Carburization (cementation) of metal-containing articles or layers.

2137 (1933). Aluminium, Ltd. Aluminium-silicon alloys.

14,475 (1933). Siemens & Halske A.-G. *See* VIII.

14,762 (1933). Beryllium Corp. Beryllium or alloys thereof.

16,044 (1933). Barrett Co. Pickling compound.

34,010 (1933). City Auto Stamping Co. Metal finish.

**XI.** 15,733 (1933). Uranschek. *See* IX.

**XIII.** 12,946–8 (1933). Sander. Production of colouring bodies and pigments.

15,864 (1933). I. G. Farbenind. Manufacture of shaped articles from heavy metal salts of polymeric carboxylic acids.

34,010 (1933). City Auto Stamping Co. *See* X.

**XIV** 31,816 (1932). Geer. Rubber surfaces.

31,817 (1932). Geer. Treating rubber surfaces.

5977 (1933). Naugatuck Chem. Co. Treatment of rubber.

15,995 (1933). Pennel and Flipo. Applying rubber and obtaining the latter in a spongy state on fabrics etc.

**XV.** 14,891 (1933). Soc. Chem. Ind. in Basle. *See* VI.

**XVI.** 16,232 (1933). Reichsverband des Deuts. Gartenbaues. *See* XIX.

**XVIII.** 16,036 (1933). Mehlitz. Manufacture of beer.

**XIX.** 16,232 (1933). Reichsverband des Deuts. Gartenbaues. Protecting vegetable and animal goods during storage.

**XX.** 15,772 (1933). St. Louis University. Hormone and process of obtaining the same.

**XXI.** 15,954 (1933). Kodak, Ltd. Photographic printing.

33,312 (1933). I. G. Farbenind. Manufacture of photographic sensitizers.

**XXII.** 16,027 (1933). Imperial Chem. Industries. Blasting explosive cartridges.

# GENERAL NOTES

## Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific number. *Egypt:* Steel plates etc. (G.Y. 13,225). *Finland:* Heavy and industrial chemicals (673). *Holland:* Ferro-silicon for iron industries (676). *Italy:* Oils and fats for soap, paper, colours, resin, and raw materials used in the manufacture of paints and varnishes (677). *New Zealand:* Paint, lacquer, varnish, etc. (667).

## Import Duties Advisory Committee

The Import Duties Advisory Committee gives notice of applications for an increase in the import duty on pressed iron or steel shelf or angle brackets, lead acetate, and superphosphate; and for the exemption of fireproof non-vitrified earthenware cooking utensils from the further additional duty imposed by the Additional Import Duties (No. 8) Order, 1933. The committee also gives notice of an application for additional duty on, and an application for the addition to the Free List of, asbestos cement products, including asbestos cement roofing slates, tiles, corrugated sheets, and wall covering sheets. Any representations in regard to these applications should be addressed to The Secretary, Import Duties Advisory Committee, Caxton House, Tothill Street, London, S.W.1, not later than Jan. 8, 1934.

## Changes of Address

We are informed that Messrs. Mining and Industrial Equipment, Ltd., of 11, Southampton Row, London, W.C.1, have moved their offices to Aldwych House, Aldwych, W.C.2 (4th floor). Telephone Holborn 2002.

The Podbielniak Industrial Research and Analytical Laboratories announce that they have established new laboratories and offices at 222, East Superior Street, Chicago, Ill. This concern specializes in the manufacture of high- and low-temperature fractionation apparatus and the maintenance of a consulting and research service.